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readily obtained. In numerical problems the task of solving the transcendental equations (7) or (10), and (7a) presents no practical difficulty.

NUMBER THEORY AND DIOPHANTINE ANALYSIS.

172. Proposed by H. C. FEEMSTER, York, Neb.

Show that $\frac{(nr)!}{n!(r!)^n}$ is an integer.

Solution by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

By induction we get the following:

Suppose $r(n-1)!$ is divisible by $(r!)^{n-1}(n-1)!$. Now

$$\begin{aligned} \frac{(nr)!}{n!(r!)^n} &= \frac{r(n-1)!}{(r!)^{n-1}(n-1)!} = \frac{(nr)!}{r(n-1)!} \times \frac{(n-1)!}{n!r!} \\ &= \frac{nr(nr-1)(nr-2)\dots \text{to } r \text{ factors}}{nr(r-1)!} \\ &= \frac{(nr-1)(nr-2)\dots \text{to } (r-1) \text{ factors}}{(r-1)!} = \text{an integer.} \end{aligned}$$

Now $\frac{r!}{r!1!} = \text{an integer}$, and hence $\frac{(2r)!}{(r!)^22!} = \text{an integer}$; $\frac{(3r)!}{(r!)^33!} = \text{an integer}$,

and so on.

173. Proposed by V. M. SPUNAR, M. and E. E., East Pittsburg, Pa.

Find integral values satisfying the equation,
 $a_1^2 + a_2^2 + a_3^2 + \dots + a_n^2 = d^4.$

I. Solution by FRANK LOXLEY GRIFFIN, Ph. D., Williams College.

One set of solutions may be obtained by putting $a_1 = df_1$, $a_2 = df_2$, etc., which reduces the problem to that of finding a sequence of n integers, the sum of whose squares is a perfect square. Or, geometrically, we seek $n-1$ right triangles whose sides are all integers, and the hypotenuse of each being one leg of the next.

I. This is readily accomplished for $n=2$ by recalling that, if $(p^2 - q^2)$ and $2pq$ are legs, where p and q are integers, the hypotenuse is also an integer, $(p^2 + q^2)$. Let f_1 be *any odd integer* (>1) and take $p - q = 1$ and $p + q = f_1$, so that $p = \frac{1}{2}(f_1 + 1)$, $q = \frac{1}{2}(f_1 - 1)$, both integers. Thus the sides